

Location in Surveys Unit Field Surveys for Hydraulic Data

Revision 12-98

It is the intent of Location and Surveys to provide generic survey data to the Hydraulics Unit for their designs. The guidelines are to be used for general project development and should be applicable to all projects. Special situations will be investigated by Hydraulic engineers and necessary data will be obtained by the Hydraulic unit.

The Location and Surveys Group Leader, or assistant, should contact the Hydraulic Unit and discuss the Hydraulic needs as a part of scoping the project. When available and determined necessary, a Hydraulics engineer will do a field review with the Group Leader, or designee, to define the Hydraulic needs on the project. Typically, a Hydraulic Engineer has not been assigned the project at the time of Location's initial surveys; however, they will be able to give guidance in project needs.

Project scoping should include an evaluation of the safety for employees performing the field surveys. If the water depth or speed present a safety concern that concern should be documented and conveyed to the Hydraulics Unit. This documentation should be included in the project survey report and shown in appropriate CADD files. At no time should employees enter water without the necessary safety procedures implemented. In addition to water hazards, the individual scoping the project should be aware of the restriction of employees entering confined spaces. No one shall be allowed to enter a manhole, catch basin, or culvert without proper safety procedures being followed. If entry is required, assistance must be made coordinated with the Division Safety Engineer.

The guidelines are available on the Location and Surveys web site (<http://www.doh.dot.state.nc.us/>) under the Support area. Updates will be made to these files and attempts will be made to inform all users of the updates.

The guidelines are broken down into the following categories:

Waterways: any definable drainage way including but not limited to ditches, gullies, streams, channels, and rivers.

"T" lines: reference lines to allow hydro surveys to be completed and/or extended.

Cross pipes in drainage networks: existing pipes under roadways and losed drainage systems including catch basins, drop inlets, manholes and interconnecting piping networks. All cross pipes and network data are to be shown in a graphics file along with required elevations. Photogrammetry will merge this data with their files negating the need for classification of these features. Having this data in the graphics file eliminates the need for text files showing alignment relationships.

Box culverts and Bridges: structures bridging existing waterways. All structure data is to be shown in a graphics file eliminating the need for text files.

The private engineering firms that do work for the Hydraulics Unit are given the field survey data compiled by Location. The Hydro estimates are based on Location providing the base data and the PEF supplementing the data as needed.

All drainage structures, except driveway pipes, are to be in a graphics file. Place a note on the classification photo that hydro structures are in a graphics file.

Hydraulics Survey Guidelines

Waterways

Waterways are in any definable drainage way including but not limited to ditches, gullies, streams, channels, and rivers.

The base width will determine what DTM data the Hydraulics Unit will need. The determining factor will be a bottom width less or greater than 1 meter.

Perennial is defined as waterways having a year-round flow.

Non-perennial is defined as waterways having no flow or only flow during and after wet conditions.

The field engineer should determine if a waterway is perennial or non-perennial.

All data collected should be transmitted with the .DTL and the .TNL files. There will be no text files required.

Perennial Waterways Less Than 1 Meter

Provide an underwater breakline along the deepest part of the waterway. (See Figure 2)

Non-perennial Waterways Less Than 1 Meter

It will be left to the discretion of the field engineer on non-perennial waterways less than 1 meter to utilize feel or photogrammetric surveys to collect the DTM drain line.

Waterways not visible by photogrammetric methods, provide a drain line along the deepest part of the waterway. (See Figure 2)

Perennial and Non-perennial Waterways Greater Than 1 Meter.

Provide a minimum of 4 breaklines for waterways greater than 1 meter (See Figure 3) along with a drain line or underwater breakline.

Waterways that are unsafe, a stream should only be collected at water's edge. A note should be made in the .DTL file on Level 45 indicating why underwater shots were not collected. (See Figure 4)

It will be left to the Field Engineer to decide if a waterway is unsafe to collect underwater shots.

Waterways on New Location

Typical sections or shoulder point information should be obtained from the project planning document or public hearing map.

All waterways not visible by photogrammetric methods inside the proposed shoulder points, will need to be surveyed according to the guidelines listed. (See Figure 1)

Additional data required as a result of an alignment shift will be obtained by Hydraulics survey team.

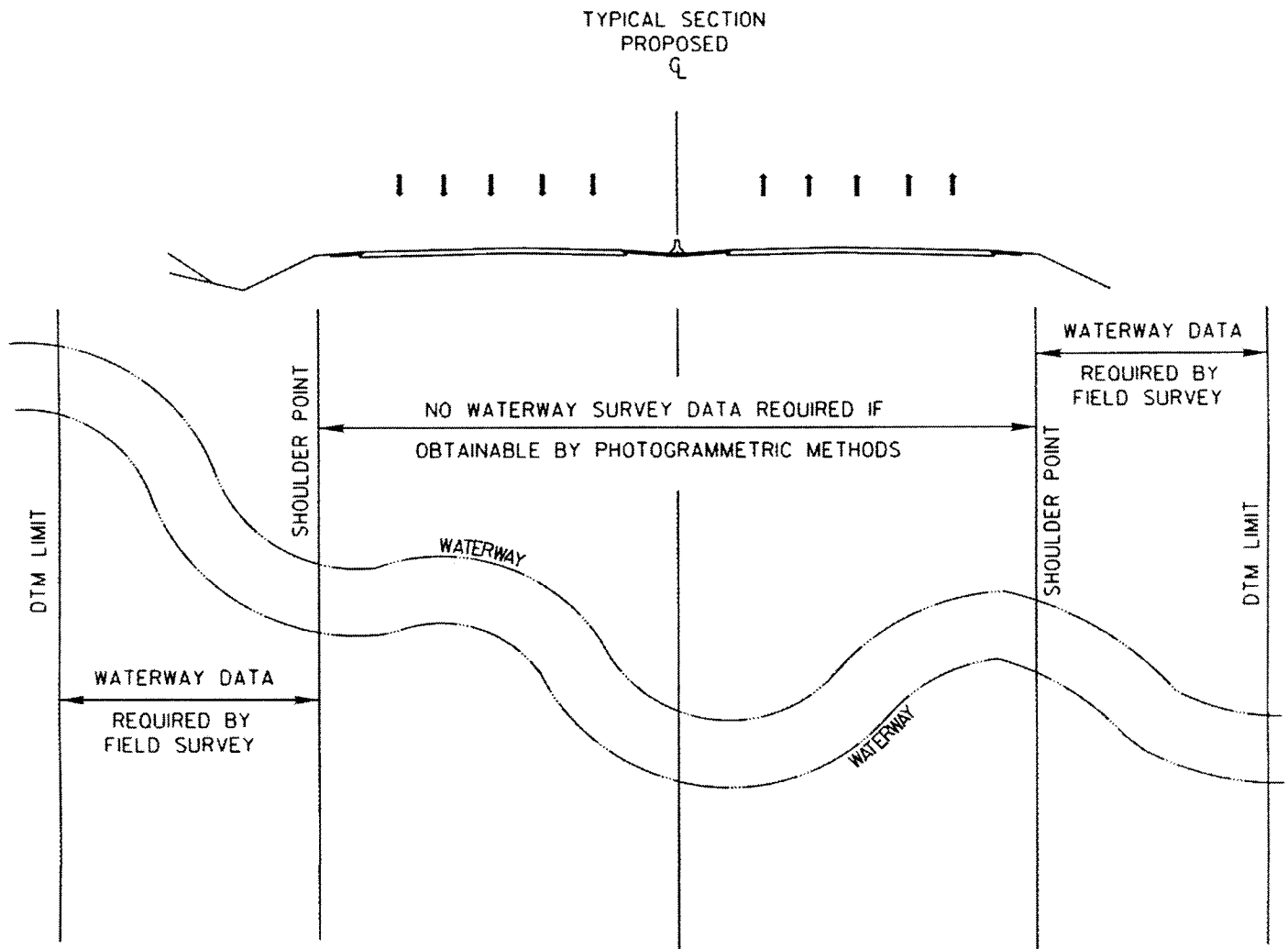


Figure 1

Required DTM Data for Waterways With a Base Width Less Than 1 meter
(Perennial or Non-perennial)

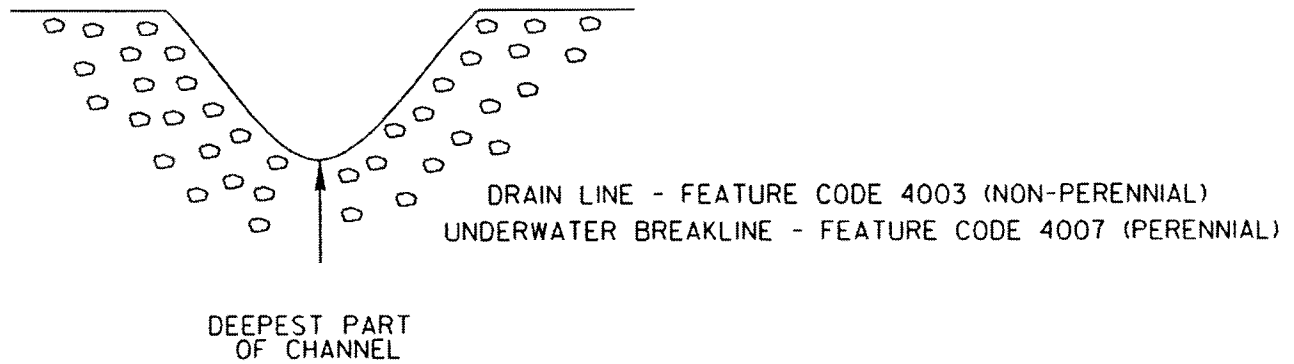


Figure 2

Required DTM Data for Waterways With a Base Width Greater Than 1 Meter
(Perennial or Non-perennial)

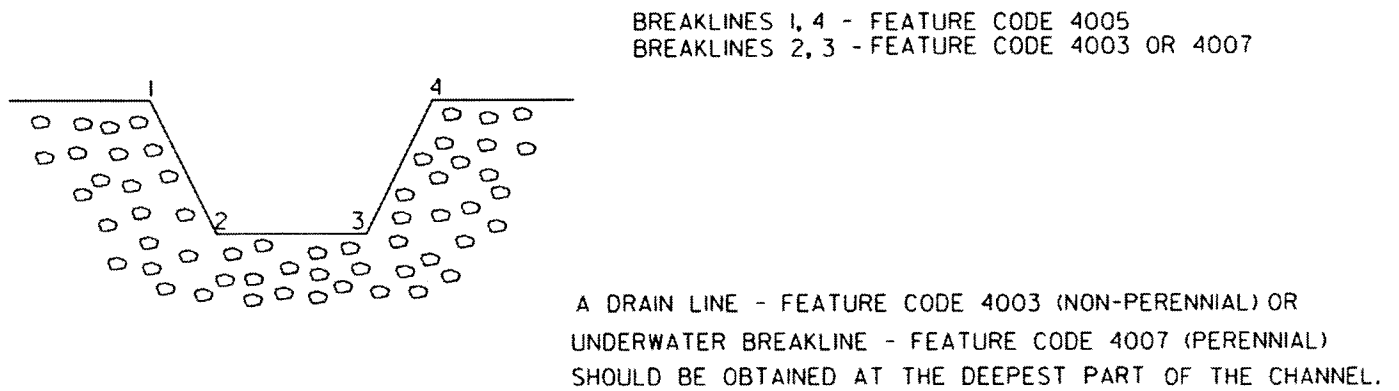


Figure 3

Waterways That are Unsafe for Collection of Underwater Shots.

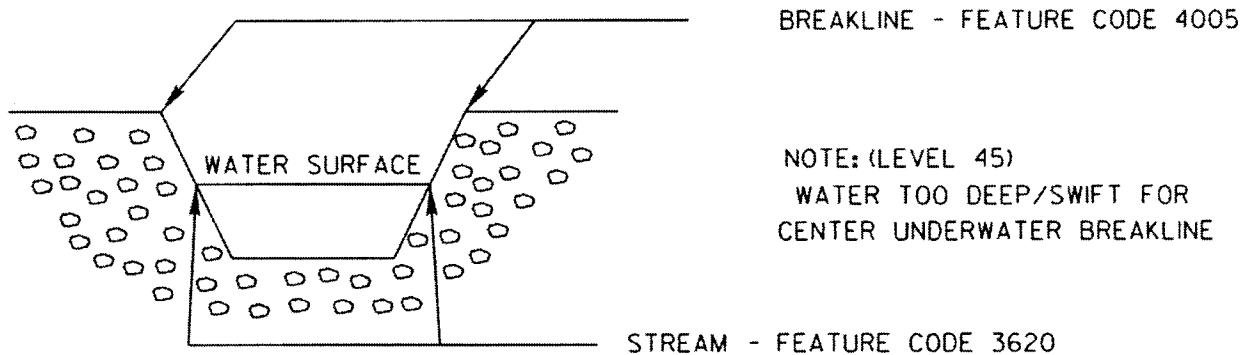


Figure 4

Waterways Along Existing Roadways

Provided drain line along the waterway beginning or ending at existing culverts. (See Figure 5)

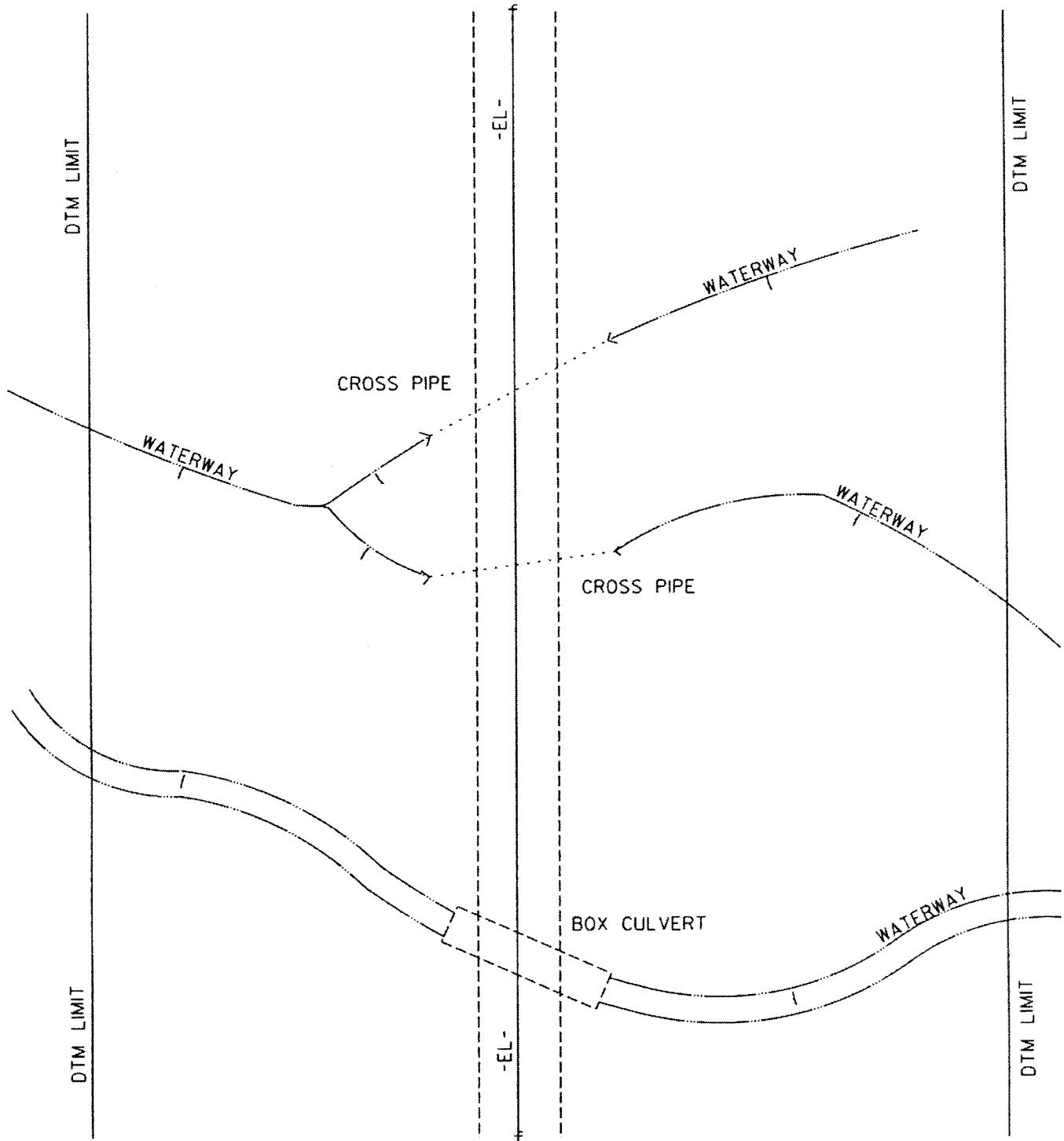


Figure 5

Hydraulic Survey Guidelines for Location of "T" Lines

Baseline For Hydraulics (-T- Line)

The purpose of the Hydraulic -T- line is only to provide a baseline on the ground from which preliminary hydraulic data can be collected by the route location & survey engineer and additional information can be obtained as needed by the Hydraulics Unit or the contracted Hydraulic Engineer. -T- lines should be established in the field at all waterways (i.e. rivers, creeks, streams, branches, ditches, etc.) that have a consistent 3 feet base width through the project survey limits. If the waterway is generally parallel with the baseline (-BL-) and in close proximity, a separate -T- line is not required. The -BL- will serve as the hydraulic control baseline to obtain hydraulic data in these instances.

-T- line Field Location:

-T- lines should be set generally parallel with the waterway and in the vicinity of the top of bank of the waterway. At the request of the State Hydraulics Engineer, for proposed bridges, the length of the -T- line should extend at a minimum from the proposed -L- line crossing of the waterway the greater of 200 feet or 2 bridge lengths (greater of the existing bridge length or the proposed bridge length) downstream and upstream or to the requested DTM limits, whichever is greater (See Figure 7 of Hydraulic Survey Guidelines). Any -T- lines should have at minimum two set points, one of which should be an intersection point with the (-BL-). The intersection point should be an actual -BL- point with an iron pin and cap if there is the potential for major structure construction. If there is only a minor drainage system planned and no potential for any major structure construction, an intersection point set in line between two -BL- points will suffice. If the intersection point is set in line between two -BL- points, it will be considered a part of the -T- line only and not a control point on the -BL-. A 12" spike nail, rebar with no cap, or equivalent will suffice as durable construction for later use by the hydraulics engineer. A red topped wooden survey stake or red carsonite marker should be placed next to the set point with the point number and station labeled on the stake. -T- Line control points should be numbered and labeled by alignment, (i.e.-T1-101, -T1-102, T2-101, etc, where T# is the -T- line number and -### is the point number). All baselines for -T- lines should begin at the furthestmost left point with T#-###, if looking up stationing of the baseline (BL), and continue with sequential numbering till the end of the project limits. Obviously, sequential numbering of -T- line points is the goal; however, due to additional requested work, required equalities, etc. these types of acceptable exceptions may inhibit sequential numbering to be achieved in all cases. All -T- lines should be stationed and begin at the furthestmost left point of the -T- line limits with station 5+00.00, if looking up stationing of the baseline (BL), and continue with increasing stationing to the right till the end of the -T- line limits. Stationing of the -T- line control points and inter-visibility between -T- line points is required; however, intermediate staking is not necessary.

Text File and Graphics Format:

-T- lines will be documented in the baseline alignment text file (*.TXT) and the Microstation graphics file. All -T- line text alignments will include all traverse points with point numbers, North and East Coordinates with Elevations, station of points, and type of point set (i.e., nail set, rebar, PK nail etc.). Bearing and distance should be provided between adjacent points in the text file. The following statement should be included in the text file:

Caution: This -T- Line is a secondary traverse only and should not be used for construction of complex structures. For more information please contact Locating Engineer in charge of surveys.

In the graphics format, -T- lines should appear in the Microstation CADD file generated for the -BL- and -BY- alignments (i.e. TIP#.BLN) on Level 45. -T- line traverse points will appear with the default point symbol, -T- line station value, point number, elevation, and bearing labeled on connecting lines.

EXAMPLE OF PROJECT -T- LINE (TIP#.BLN)

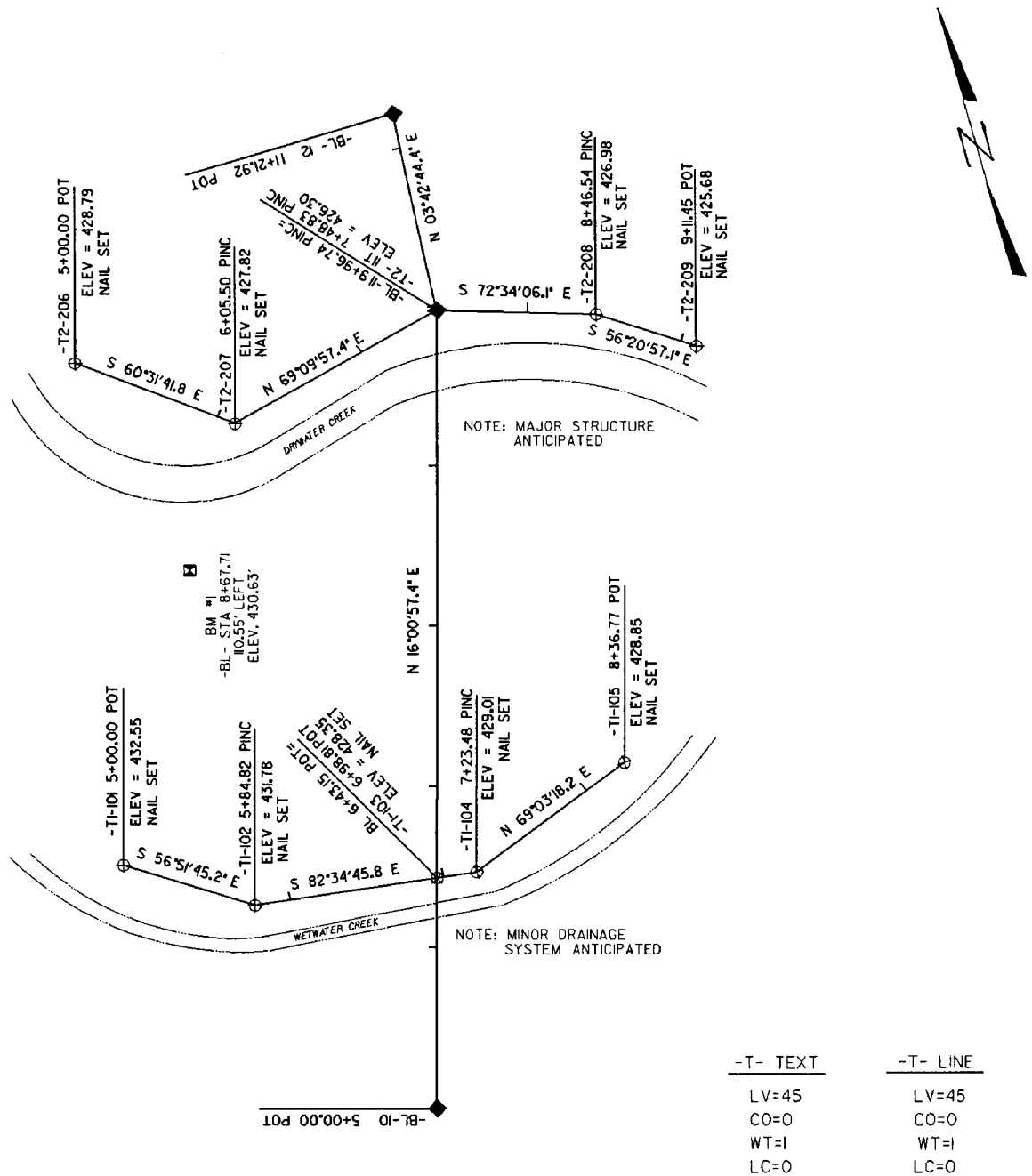


FIGURE 7

Minor Structures

Hydrographic data for all minor structures are to be shown in graphic files. Showing this data in graphic format negates the need for text files. See Figure 8 for examples of cross pipes and drainage networks. Sanitary sewer manholes should be in a graphic file as per Figure 8 and placed in .UTL or .BRL files. If inverts are taken from as-built plans, a note should be placed on level 45 indicating such. Invert elevations from as-built should be related to project datum.

SEE ILLUSTRATION #1

FIGURE 9

2.0 CONC HW
INV. = 252.314

600mm CONC

INV. = 252.115

TOP = 253.214
INV. = 252.314

DCB

375mm CONC

INV. = 252.233

MH

SEE ILLUSTRATION #2

FIGURE 9

TOP = 253.533
INV. = 250.698

SEE ILLUSTRATION #3

FIGURE 9

450mm CONC

INV. = 252.116

INV. = 252.165

TOP = 253.625

CB

450mm CONC

INV. = 252.569

INV. = 252.214

INV. = 252.569

TOP = 253.609

450mm CONC

SEE ILLUSTRATION #4

FIGURE 9

INV. = 253.386

INV. = 253.523

TOP = 255.494

INV. = 253.924

TOP = 254.233

INV. = 253.408

200mm TC

375mm CONC

MH

TOP = 255.091

INV. = 254.129

SEE ILLUSTRATION #5

FIGURE 9

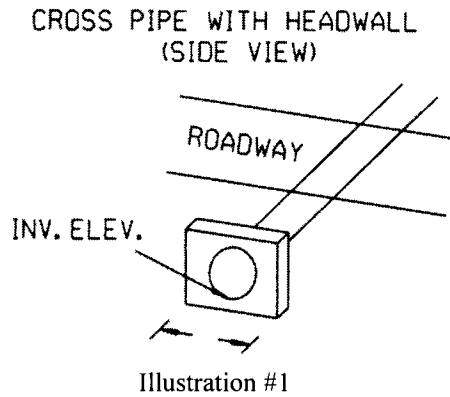
TOP = 255.498

INV. = 254.608

CB

Figure 8

All shots should be X,Y,Z unless noted by.



Hydrographic information should be on the following levels in .BRL or .HYL files.

All minor structures Level 6

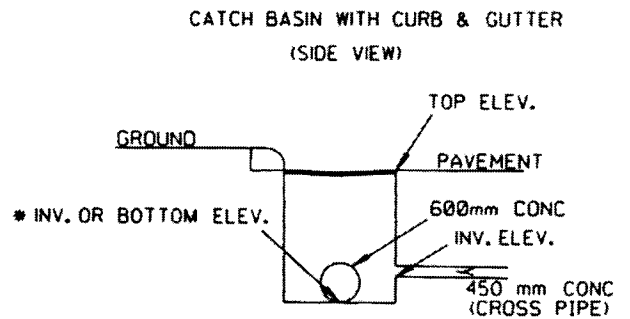
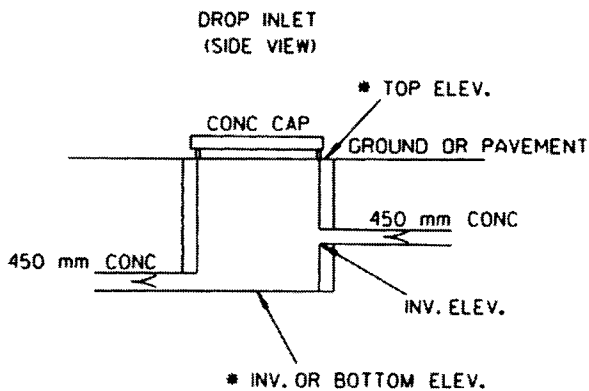
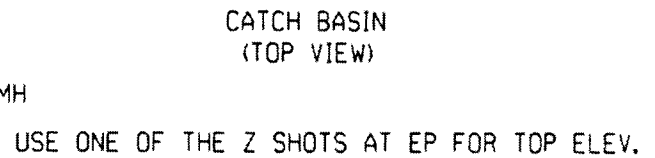
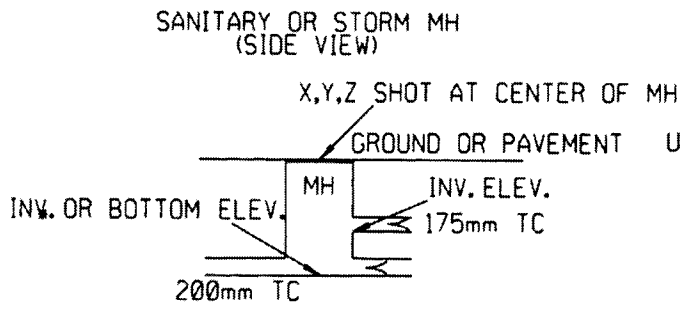
(including catch basins and drop inlets)

Material type, size, etc. Level 26

All top and invert elevations Level 45

No elevation needed on headwall

Sanitary sewer information should be put in TIP#.UTL or .BRL file. Top and invert elevations on Level 45.



Major Structures Existing Box Culverts

A minimum of 8 shots are needed for any box culvert. (See Illustrations 7 & 8) The location of these shots should be labeled in the design file.

CUL - designates X,Y, and Z coordinates at the inside corners.

HW - designates centerline top of headwall elevation.

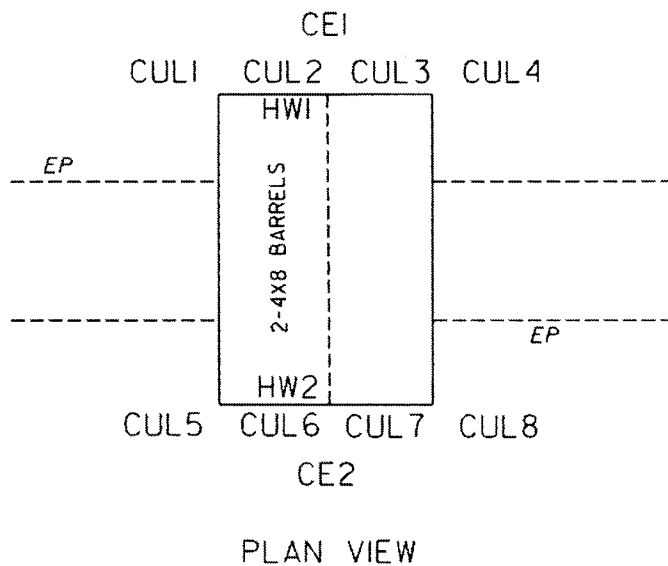
CE - designates centerline bottom of top of slab elevation.

Note: The location of the HW shots should be painted on the culvert.

The information collected will be shown in a tabular format adjacent to each culvert. (See Illustration 6)

Hydrographic information should be on the following levels in .BRL or .HYL files.

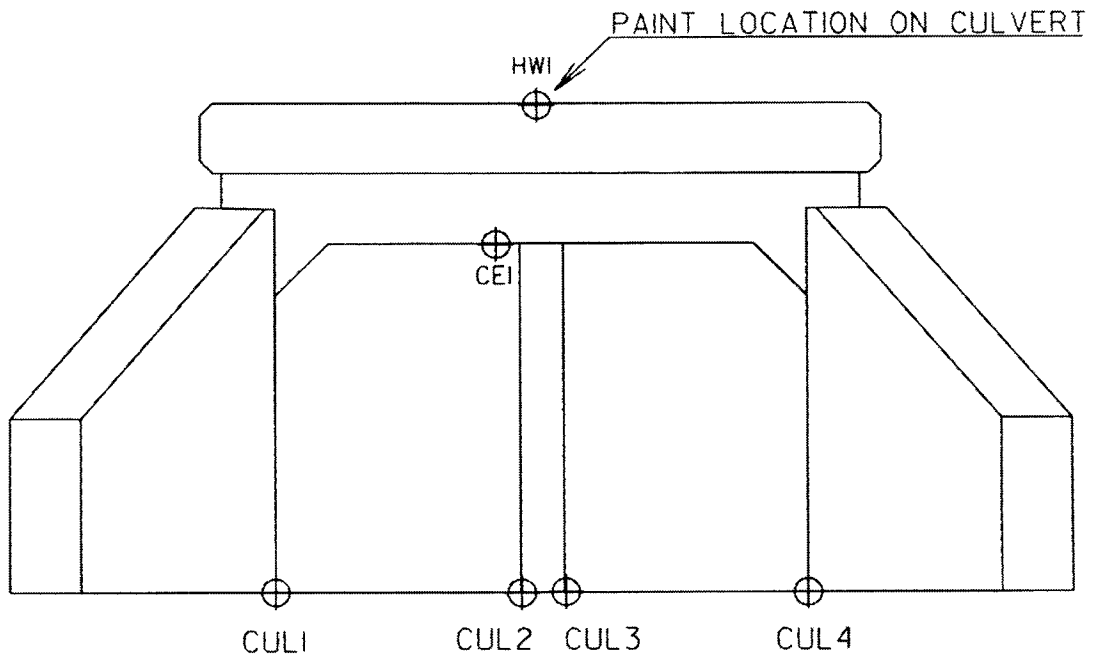
All major structures	Level 5
Material type, size, etc.	Level 25
Tables and shot location tags	Level 45
Label size and number of barrels on Level 25	



CULVERT #1 DOUBLE BARREL			
	NORTH	EAST	ELEV.
CUL1			
CUL2			
CE1			
HW1			
CUL3			
CUL4			
CUL5			
CUL6			
CE2			
HW2			
CUL7			
CUL8			

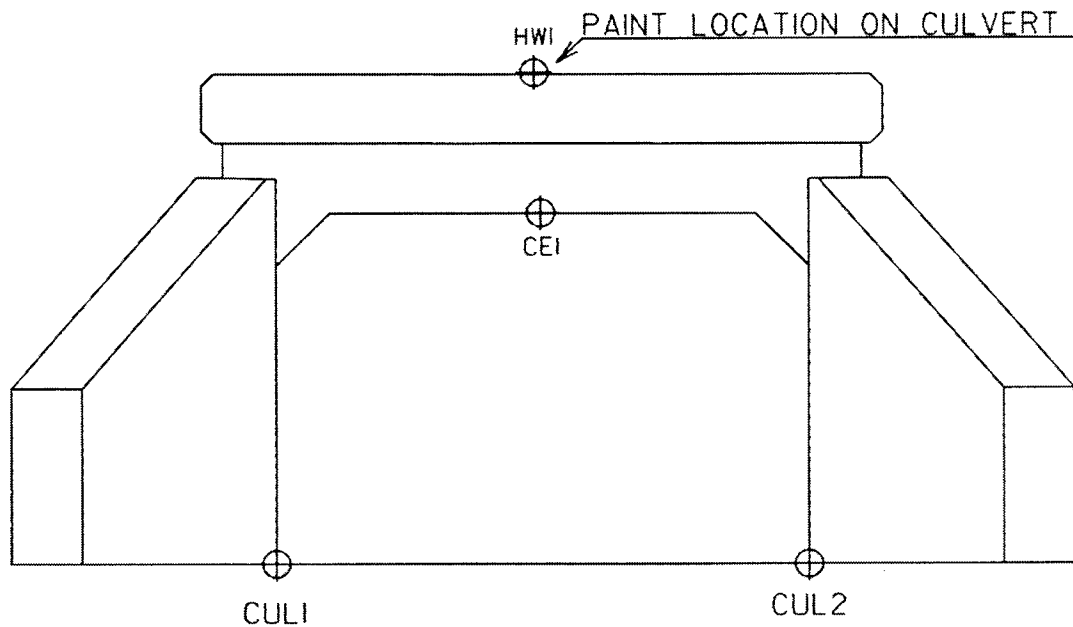
Illustration 6

ILLUSTRATION 7



MULTI-BARREL CULVERT
(END VIEW)

ILLUSTRATION 8



SINGLE BARREL CULVERT
(END VIEW)

Major Structures Bridge crossings

Show bridge seat elevations at lowest beam on Level 45 in .BRL or .HYL files. (See Illustration #9)

Show dashed lines along bridge bents in .BRL or .HYL files. (See Illustration #10)

Bridge inventory number will be shown on Level 25.

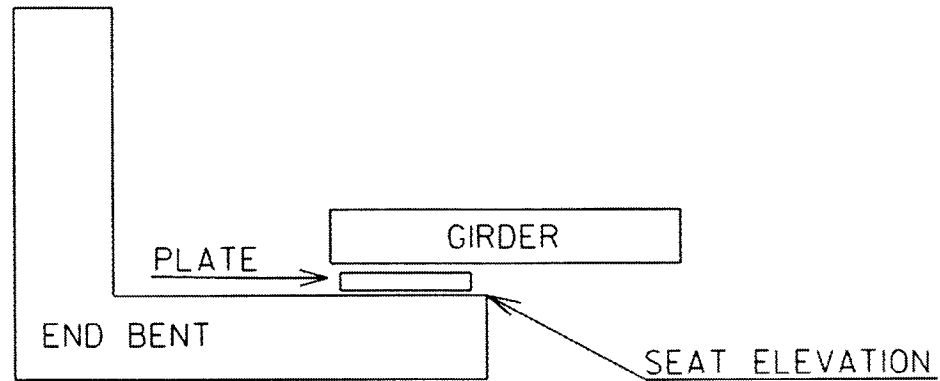


Illustration #9

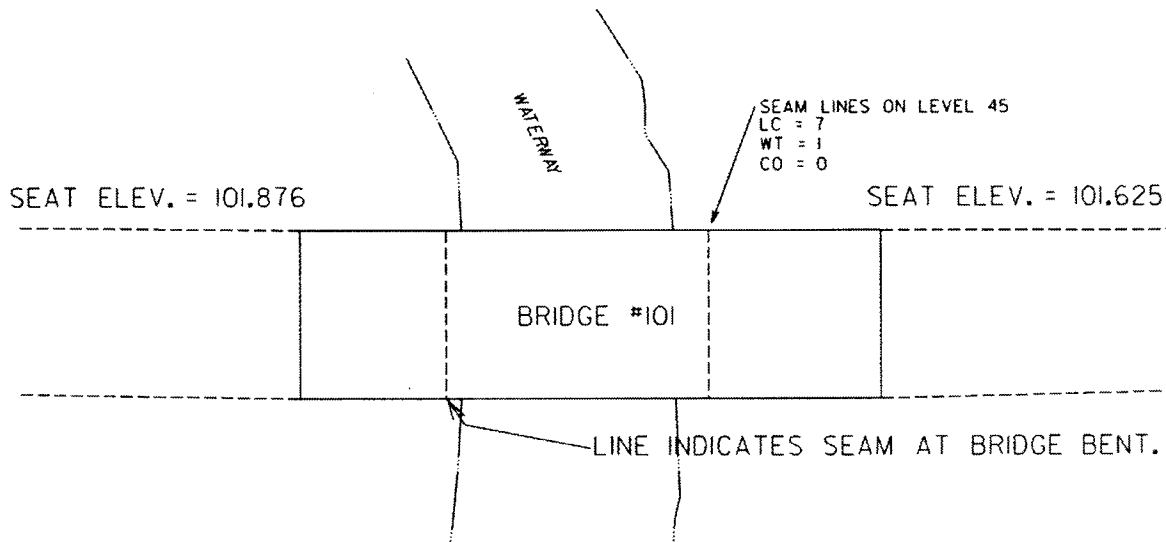


Illustration #10